meat and grease to burn for cooking it; but the utmost anxiety was caused by the wearing out of the aluminium stove and cooking utensils. As regards clothing, the Italians found woollen material much more useful and satisfactory than furs. The point is discussed at some length by Dr. Cavalli, who observed that light porous cloth allowed the perspiration to pass to the outside before freezing, and there it could be scraped off and the clothes kept comparatively dry; whereas when skin clothing of any kind was used, snow and ice were formed on the inner surface, and when warmed in the sleeping-bag the clothes were saturated with moisture.

The Italian and Norwegian members of the expedition appear to have been on the best of terms throughout, and but for the loss of the first party returning from the great journey over the sea-ice, their year in the Arctic regions must be pronounced a most successful one. What is now wanted in the interest of science is no mere dash to the Pole, no more experiments as to modes of travelling, but a repetition of the drift of the *Fram* from a point north of Bering Strait, with abundant equipment for oceanographical, meteorological and magnetic research. It would cost but a trifle compared with the expense of an expedition with dogs and stores enough to ensure reaching a very high latitude from any land base, and the value of the results is certain, though five years might not be too much to allow for obtaining them. It is a great opportunity, ready for some wealthy person with a love of solitude and science.

THE RESTORATION OF THE LAND OF CHALDEA.

TWO lectures by Sir William Willcocks, late Director-General of the Irrigation Works in Egypt, delivered before the Khedival Geographical Society at Cairo, have been published in a pamphlet,[1] a copy of which has been received. Sir William Willcocks, as is well known, is an enthusiast in irrigation matters, and has had a very large share in bringing Egypt to its present state of prosperity by the reorganisation of the canal and reservoir system, and in designing the new works that have recently been carried out at Assuan. The pamphlet under notice relates to the ancient country of Chaldea, which bears a great resemblance in its physical features to Egypt, the river Tigris being capable of performing the same functions as the Nile.

In view of the proposed Bagdad Railway, which will traverse this delta, the subject is of considerable interest. The author's view is that the resuscitation of the ancient canal system would create along the line of railway a country as rich as Egypt, the rent of which would pay for both railway and irrigation works, and leave a surplus "which only those can realise who have been in intimate touch with Egyptian Agriculture."

Bagdad lies at a distance of about 500 miles from the sea, measured along its course. From the city to the Persian Gulf is a country now completely desolate, but which formerly was one of the most fertile and populous districts in the world. Opis, situated on the banks of the Tigris, and which was at one time the wealthiest mart of the East, bears to the delta of the Tigris very much the same relation that Cairo bears to the delta of the Nile; and here were situated the head of the great canals which irrigated the delta. The great Nahrwan canal had its intake in this locality, and extended for a length of about 250 miles, feeding an immense number of subsidiary canals. This canal, for the first ten miles of its course, was cut through hard conglomerate rock to a depth of 50 feet, and was 65 feet wide, increasing lower down to 394 feet. These dimensions considerably exceed those of the largest irrigation canal in Egypt. It was described as late as 970 A.D. as flowing amid continuous and extensive villages, date groves, and well-cultivated lands, the whole region over an area of 4600 square miles containing a population, judged from the ruins left, that no spot on the globe could excel. Owing to neglect of the works the main stream of the Tigris became diverted, the old bed of the river silted up, and the ruin of the irrigation system became complete, and now the ruins of Opis and many other mounds of adjacent buildings spread like islands over the deserted plain, which is quite bare of vegetation. The author of the pamphlet estimates that there are about one and a quarter million acres of first-class land of the value of 38,000,000*l.* that could be reclaimed and once more made prosperous by an outlay of 8,000,000*l.*, and which would produce a rental of 3,840,000*l.* Beyond this is an area of one and a half millions of acres of less fertile land, that could also be reclaimed and cultivated.

The second lecture is a description of what Egypt will be in fifty years' time, according to the author's ideas, when the country "will attain a height of splendour and magnificence." which will surpass the great works of the days of the Pharaohs, which have survived the revolutions and catastrophes of four thousand years.

[1] "The Restoration of the Ancient Irrigation Works of the Tigris; or, the Re-creation of Chaldea"; and "Egypt Fifty Years Hence." By Sir William Willcocks. Pp. 71; with 10 plates. (Cairo: National Printing Department, 1903.)

THE DALTON CELEBRATIONS AT MANCHESTER.

THE Manchester celebrations in connection with the centenary of Dalton's atomic theory began on Tuesday afternoon, May 19, when Prof. F. W. Clarke, chairman of the International Commission on Atomic Weights, delivered the "Wilde" lecture on "The Atomic Theory" to the Manchester Literary and Philosophical Society. Addresses were presented on behalf of the Royal Society and the Chemical Society, and a message was received from the Russian Physico-Chemical Society. In an admirable discourse Prof. Clarke sketched the history of the atomic theory from its first conception in the minds of Greek philosophers down to the present day. He pointed out the directions in which the atomic theory would probably develop, but declared that the problem of matter would never be solved until the atomic weights of the elements had been finally settled. "Who," he asked, "will establish the Dalton Laboratory for pure research, and so give the work which he started a permanent home?"

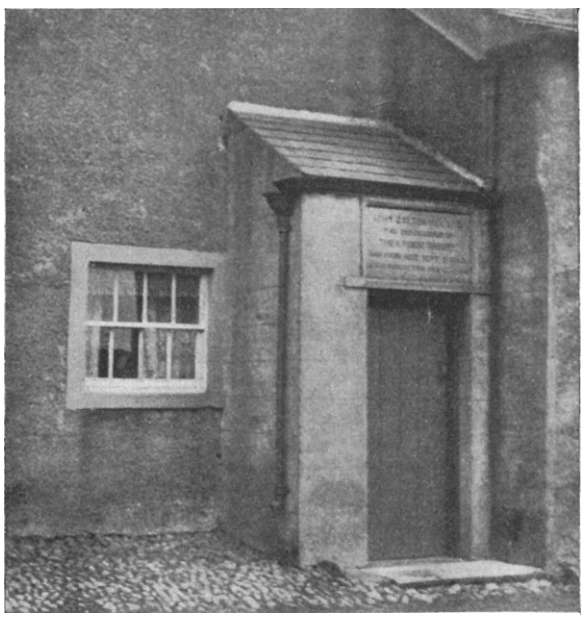
In the evening the Literary and Philosophical Society gave a dinner, at which the principal guests were Profs. Clarke and van 't Hoff, Prof. A. E. Armstrong, Mr. Brereton Baker, Prof. P. F. Frankland, Mr. Vernon Harcourt, Dr. Harden, Sir James Hoy, Prof. Kipping, Dr. W. H. Perkin, sen., Sir William Ramsay, Prof. Emerson Reynolds, Sir Henry Roscoe, Prof. Smithells, Dr. Scott, Prof. Thorpe and Prof. Tilden.

In proposing the toast of the evening, the "Wilde" medallist—Prof. Clarke—and the Dalton medallist—Prof. Osborne Reynolds—Sir Henry Roscoe said that Dalton's atomic theory and Joule's discovery of the mechanical equivalent of heat reflected more distinction on Manchester than the city's association with the cotton industry or with the Ship Canal.

On Wednesday morning a special meeting of the Owens College Chemical Society was held to offer an address to the great Dutch chemist, J. H. van 't Hoff, now professor at the Berlin University. Prof. Dixon

was in the chair. The address was presented by Mr. Norman Smith, a former student under Prof. van 't Hoff. The professor, who was enthusiastically received, said the question was often asked, nowadays, whether the atomic theory had not outlived its utility. His reply was that, in dealing with natural phenomena, with states of unstable equilibrium, the atomic theory was indispensable for essential explanations. He had come to regard the conception of the carbon atom as the centre of a tetrahedron as childish, but it contained the germ of a profound truth, the solution of which must be left to the future. He suggested that valency was due to an equilibrium. The four mutually repellent "electric atoms" of Helmholtz were kept in equilibrium by their attraction for the carbon atom at the centre.

Later in the morning Earl Spencer, Chancellor of the Victoria University, conferred the honorary degree of Doctor of Science on Prof. Clarke and Prof. van 't Hoff, who were presented by Prof. Dixon. After the conclusion of the ceremony Prof. van 't Hoff laid the



Memorial Tablet over door of house in which John Dalton was born. From a photograph supplied by Mr. A. Humphreys. The inscription on the tablet reads:—"John Dalton, D.C.L., LL.D., the Discoverer of The Atomic Theory, was born here Sept. 6, 1766. Died at Manchester July 27, 1844."

first stone of the proposed extension of the Owens College Chemical Laboratories, and was presented, as a memento of the occasion, with a silver trowel by the College Chemical Society. The celebrations were concluded by a soirée held at the Owens College on Thursday night, when Dr. Harden gave an interesting account of John Dalton, and many Dalton relics were exhibited by the Manchester Literary and Philosophical Society, Prof. H. B. Dixon, Mr. Theodore Neild, Mr. G. W. Graham and Mr. G. S. Woolley. E. C. E.

THE ATOMIC THEORY AND THE DEVELOPMENT OF MODERN CHEMISTRY.

MANCHESTER celebrated last week, just a little prematurely, the centenary of John Dalton's atomic theory. It was on September 6, 1803, that he drew up in his notebook his first table of weights of the "ultimate atoms" of hydrogen (which he took as his unit), oxygen, "azot," carbon, sulphur, and of water, ammonia, nitrous gas, nitrous oxide, and other binary compounds of these elements. With regard to the genesis of the theory in his own mind much doubt has prevailed until recently. Dalton himself told Thomas Thomson in 1804 that he had been led to the theory from his work on marsh gas and olefiant gas. He told W. C. Henry in 1824 that his speculations were suggested by the work of Richter. And yet, oddly enough, as Sir Henry Roscoe and Dr. Harden have shown in their "New View of Dalton's Atomic Theory" the evidence is dead against the accuracy of these plausible statements. Dalton's own notebook shows that his atomic theory preceded his work on marsh gas, and his notes for a lecture delivered in 1810 give a history of his ideas which agrees with all the facts.[1]

It was from Newton that Dalton derived his belief in the atomic hypothesis. And we can trace the "solid massy, hard, impenetrable, moveable particles" of Newton, through his friend Boyle, through Gassendi, and through Bacon (who considered Democritus to be the greatest of Greek philosophers) back to Epicurus and to the originators of the atomic theory, Democritus and Leucippus. Dalton's theory of atoms is historically the Greek theory of atoms. But with a difference.

Boyle, who was a far more thoroughgoing atomist than is generally supposed, really rejects the hypothesis of different elements which he himself originated, considering that differences of atomic structure and arrangement of a single form of matter would account for all chemical transformations.[2]

But Boyle's own definition of an element, as a substance which could not be decomposed, proved far more fruitful than his atomic beliefs, and the work of his successors—of Marggraf, of Black and Cavendish, of Scheele and Bergman, of Priestley and Lavoisier—had gradually established in the minds of chemists the idea, rejected by Boyle, that there existed a series of elements not convertible into one another. It was to that series of elements, unknown to the ancients, that Dalton applied the atomic hypothesis. He came to the conclusion that the atoms were not of all kinds of shapes and forms, as had been previously supposed, but that the atoms of the same element were all identical in weight, while the atoms of different elements were different in weight. It was an idea that might conceivably have occurred to some chemist fifty years earlier. But, in spite of Black's work, the phlogiston theory had led chemists before Lavoisier to lay small stress on the notion of weight. Dalton could hardly have come much earlier than he did. The first announcement of his theory was made in a paper read in October, 1803, at a meeting of the Manchester Literary and Philosophical Society, in the house of which he had his laboratory; the paper was not published until 1805. Dalton's views were not fully placed before the world until the publication of the first volume of his "New Systems of Chemical Philosophy," in the years 1808–1810.[3]

Meanwhile Dalton had been carrying out researches which confirmed his view, and, together with certain assumptions, led to the most important of generalisations. Dalton himself never disengaged the

[1] Save for an obvious clerical error of 1805 for 1803.

[2] "I see not, why we must needs believe, that there are any primogeneal and simple bodies, of which, as of pre-existent elements, nature is obliged to compound all others. Nor do I see why we may not conceive, that she may produce the bodies accounted mixt out of one another by variously altering and contriving their minute parts, without resolving the matter into any such simple or homogeneous substances, as are pretended" ("The Sceptical Chymist," part vi., folio edition, vol. i., p. 369). See also p. 366, a reference to an experiment by which Boyle thought he had "destroyed refined gold and brought it into a metalline body of another colour and nature"; and p. 367, an earlier announcement of the view just quoted.

[3] The first part of this volume appeared in 1808, the second in 1810. The first part of the second volume only appeared in 1827. The work was not completed.